air barometer, the advantages of which over a mercurial barometer are compactness and portability, greater sensitiveness, greater simplicity in the calculations, and, lastly, greater cheapness.

All those who are interested in the measurement of heights by barometric methods should read these twenty-eight pages.

Laboratory Directions in General Biology. By Harriet Randolph, Ph.D., Demonstrator in Biology and Reader in Botany, Bryn Mawr College. (New York: H. Holt and Co., 1897.)

THIS booklet of 152 pages small octavo is a guide to a 142 hours' elementary laboratory course. The Fern and Earthworm are first dealt with, and then a series of animal and vegetable forms, in ascending order determined by convenience, the whole culminating in a small modicum of comparative embryology. Directions for manipulation are throughout rendered in italics. Of the making of books there is no end, but a pity 'tis that of the making of books such as this should be a beginning! The whole is but a set of rough laboratory notes of the time-table order, such as are everywhere used under prevailing custom and often destroyed when done with. They are of the kind justified only by the necessity for local adaptation of class work; but of this there is here no evidence, and we consequently regard their publication in book-form as superfluous.

The Freezing-Point, Boiling-Point and Conductivity Methods. By Harry C. Jones. Pp. vii + 64. (Easton, Pa.: Chemical Publishing Co., 1897.)

THIS little laboratory handbook is designed not merely as a guide to the manipulation of the methods of which it treats, but also to give the student an insight into the physical principles underlying them. The theoretical part is, however, in many places so compressed that, it is to be feared, the average student will hardly be able to follow it without some previous knowledge of the subject derived from other sources. The practical part is, on the other hand, very well done. It includes descriptions of Beckmann's and the author's apparatus for the determination of freezing-points of solutions, of the Beckmann boiling-point apparatus, as well as of the later forms devised by Hite and by the author, and of the Kohlrausch apparatus for the determination of the conductivity of solutions in the form described by Ostwald. The details of manipulation, on which the author's extensive practical experience of these methods entitles him to speak with some authority, should secure a hearty welcome for this book wherever laboratory instruction in physical chemistry is given.

Philip's Artistic Fruit Studies. By R. H. Wright. *Philip's Artistic Animal Studies.* By H. A. K. Dixon. (London: George Philip and Son, 1898.)

IN the lower standards of Elementary Schools the children are given various occupations, such as plaiting, crayon drawing, and macrami work, having for its object the training of the hand and eye. The collections of plant and animal studies now before us have been arranged for this purpose, and they will afford the young pupils for whom they are intended both pleasure and instruction. Each collection consists of a series of twelve original designs, simply coloured, and a series of twelve outline drawings for colouring with crayons or paints. From the fruit studies the children will learn a few details concerning common fruits; and the animal studies, containing coloured drawings of queen, male and neuter bees, the development of the frog, and similar subjects will be of value in interesting the pupils in natural history.

It would be an advantage to young pupils if the name of the object were in every case distinctly printed under both the outline and coloured drawings.

LETTER TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

"The Story of Gloucester."

MAY I ask the courtesy of a few words in further consideration of this, not in reply to your contributor, but as a plea for a little consideration to a few thoughts entertained by thousands on the other side of this controversy?

Let all the advocates of vaccination reflect that there is in the small-pox a disorder that affects the skin. That this serious damage to the skin is the real reason of the danger of the disorder; and that this damage to the skin makes any classification by skin marks a very unscientific and a very imperfect manner of dividing the cases. It is more serious than that. It makes classification by skin marks of vaccination almost certain to be erroneous. No certainty of correctness can be had, except in the mildest of the cases. In all the confluent cases, classification of the small-pox cases by skin marks will be in error with certainty. Therefore, as there has always been a most positive refusal to refer to the register of vaccinations, we have not the slightest reason for accepting the classification of hospital small-pox as correct. We have however, no other classification. We therefore must, perforce, accept for argument that classification. But we always do it with reserve.

These remarks are those which occur to us always in looking at the modern (post-vaccination) unvaccinated fatalities. If you are making a set of fatalities, which are enormously heavier than ever were recorded before Jenner began his vaccinations, then you are entitled to ask if there is in the fatality, taken as a whole, any justification for these unvaccinated fatalities, such as are now shown.

	Per cent.
Thus, Von Swieten's fatalities 150 years ago were under	2
The accepted fatality in this country before vaccination was	16
The Royal Commissioners give Chester, 1774 ...	16·8
,, ,, ,, Ware, 1722 ...	11·7
,, ,, ,, Old Small-pox Hospital, 1746-63 ...	25·3

This last is the very highest I have ever been able to find. And it is fully accounted for by the statement made in the report of the hospital in explanation of it, that "most of them were adults, often admitted after great irregularities, and some when their cure was despaired of." The hospital was small, and there was not a general admission of patients. Only free admission was allowed for those who were to have the inoculated small-pox. We have then to set against those fatalities, which are exhibited, for the most part, as showing how serious a loss of life was risked by the non-inoculated, the fatality of our own hospitals since the enforcement of vaccination. Thus—

	Per cent. died.
Metropolitan Hospital, 1870-72	18·6
Homerton Hospital, 1871-77	19·43
Metropolitan Hospitals, 1876	23
Same Hospitals for 1876-1880	17·3
Dublin, 1876-1880	21·7

In the recent years, as there has been a crowding of all the cases into hospitals, and a great deal of hospital extension—never known previously—we have a rather lower rate, as was to be expected; thus—

	Died per cent.
Fulham, 1879	16·2
Metropolitan Hospitals, 1884	15·8
Fulham, however, for 1885 was	24·3
And for Gloucester we have, 1895-96 ...	21·9

There is here nothing to boast of in the fatalities of our compulsory vaccination period. There is never so low a fatality as that recorded by Von Swieten, or by Isaac Massey at Christ's Hospital, where only one child in some hundreds died (1722), and there is no avoiding the conclusion, that I can see, that if on the whole there is no lessened fatality, there is some error in the division, which makes one set appear to be vastly better off than the other. I have tested that in this way in the Gloucester cases, by asking if there was a single class free from fatality?

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The answer is, of course, that there is not one. Government exacts multiple marks of vaccination, but in Gloucester it is clear that there was a better case for the single than for the multiple marks. Government exacts re-vaccination in the services, but here there is a large number of re-vaccinated cases, and twice Von Swieten's fatality in them.

Then, again, it is clear that the eruption has, as of old, everything to do with the fatality, and nothing can be clearer in the Gloucester cases. Unless, therefore, you have taken the precaution of giving reference to the register of vaccinations, you are in the fix of having almost certainly got wrong with your classification. Is there any test of this? There most certainly is. For in the variety of the disease, in which there is not so much damage to the skin as discoloration of it, where the poison is damaging the whole system, and internally more than externally, we have still the vaccination marks, if they are noted. I gave before the Commissioners all these cases that I had been able to trace in a large number of reports. And here is the fatality of these "malignant" cases.

	Per cent. died.
Vaccinated malignant cases	83·5
Unvaccinated cases	90
The first line divides thus—	
Vaccinated, no evidence	82
Doubtfully vaccinated	81
Indifferent vaccination marks	84
Good vaccination marks	85

It is very clear, therefore, that there is not the slightest influence in vaccination, good, bad, or indifferent, to abate the fatality of these cases. In some of the hospitals the whole of the vaccinated in this class died, without any recoveries. But that way of returning the cases is only followed occasionally, so that there is no possibility of taking all the hospital experience. There is however, no reason to suppose that it would show any different results. All these cases, with the almost unvarying total fatality, show that there is high time for a reference of every possible case returned as unvaccinated to the vaccination officer for his verification, and for information as to whether there had been the payment for successful vaccination. Till that is done, we have the right to say that there is not the slightest gain accruing from vaccination in the cures of the small-pox, and that there is all reason for declaring the present classification by skin marks in this eruptive disease unscientific and erroneous. ALEX. WHEELER.

Darlington, April 17.

[In deference to the wishes of Mr. Wheeler we print the enclosed letter, after which our columns must be closed to the subject unless something very important is brought forward. Of course, as Mr. Wheeler says, he has completely departed from the original controversy; and it is necessary to call attention to the fact that no amount of statistical jugglery, or reference to assumed historical data, can be held sufficient to refute the unquestioned fact that in Gloucester the unvaccinated children were attacked with small-pox and died in overwhelming disproportion to the vaccinated. Epidemics, as we know, cannot be compared with one another as regards their severity, but the incidence of attack in the same epidemic may always be taken as being fairly comparable throughout.—ED. NATURE.]

RÖNTGEN RAYS AND ORDINARY LIGHT.

ACCORDING to the theory of the Röntgen rays suggested by Sir G. Stokes,[1] and recently developed by Prof J. J. Thomson,[2] their origin is to be sought in impacts of the charged atoms constituting the kathode-stream, whereby pulses of disturbance are generated in the ether. This theory has certainly much to recommend it; but I cannot see that it carries with it some of the consequences which have been deduced as to the distinction between Röntgen rays and ordinary luminous and non-luminous radiation. The conclusion of the authors above mentioned,[3] "that the Röntgen rays are not waves of very short wave-length, but impulses," surprises me. From the fact of their being highly condensed impulses, I should conclude on the contrary that they *are* waves of short wave-length. If short waves are inadmissible, longer waves are still more inadmissible. What then becomes of Fourier's theorem and its assertion that *any* disturbance may be analysed into regular waves?

Is it contended that previous to resolution (whether merely theoretical, or practically effected by the spectroscope) the vibrations of ordinary (*e.g.* white) light are regular, and thus distinguished from disturbances made up of impulses? This view was certainly supported in the past by high authorities, but it has been shown to be untenable by Gouy,[1] Schuster,[2] and the present writer.[3] A curve representative of white light, if it were drawn upon paper, would show no sequences of similar waves.

In the second of the papers referred to, I endeavoured to show in detail that white light might be supposed to have the very constitution now ascribed to the Röntgen radiation, except that of course the impulses would have to be less condensed. The peculiar behaviour of the Röntgen radiation with respect to diffraction and refraction would thus be attributable merely to the extreme shortness of the waves composing it. RAYLEIGH.

April 18.

THE BAKERIAN LECTURE.[4]

THE purpose of the lecture was to show that certain metals and certain organic bodies can act on a photographic plate in such a manner that, on treating it exactly as if it had been acted on by light, a picture is developed. When carrying on some experiments with photographic plates, a piece of perforated zinc was found not to act as a screen and give a picture of the holes, but to give a picture of the metallic part; and further, it was found that a bright piece of zinc, when coated with copal varnish, with the object of stopping any emanation of vapour from it, became more, not less, active; these were the accidental observations which gave rise to the present investigation. With regard to the action of the organic bodies: their activity is greater than that of the metals, and the experiments with them are more easily carried out, hence it was advisable to investigate to a considerable extent their action before undertaking the more intricate and, probably, more important action of the metals.

Printing ink is one of the many substances which will, both when in contact and when at a distance, act on a photographic plate, and it was shown that remarkably clear pictures can be obtained of ordinary printing and of lithographic pictures. Printing ink varies in composition, and if the ordinary newspaper's, for instance, be used, the density of the pictures obtained will vary considerably. The varnish known as picture copal is also an active substance producing a dark picture. The active constituent of the printing ink was proved to be boiled oil, and in the varnish to be turpentine; and these bodies alone can be used in place of the more complicated substance above named. If then boiled or drying oil was active, it was natural to try linseed oil in its ordinary state, and this proved also to be active; different specimens, however, of so-called pure oil vary very considerably in the amount of their activity. Passing from linseed oil to other vegetable oils, they were found also to be active, but apparently none so active as the linseed oil. Then, with regard to turpentine, a body belonging to a very different class of organic substances, it was found that bodies analogous to it—all the terpines,

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[1] *Manchester Memoirs*, vol. xli. No. 15, 1897.

[2] *Phil. Mag.*, vol. xlv. p. 172, 1898.

[3] See also Prof. S. P. Thompson's "Light Visible and Invisible" (London, 1897), p. 273.

[1] *Journal de Physique*, 1886, p. 354.

[2] *Phil. Mag.*, vol. xxxvii. p. 509, 1894.

[3] Enc. Brit., Art. "Wave Theory," 1888; *Phil. Mag.*, vol. xxvii. p. 462, 1889.

[4] Delivered before the Royal Society, March 24, by Dr. W. J. Russell, V.P.R S.

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